

Investigation of Motorized Glider ì In-flight Breakupî

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Program Overview

On July 13, 1999, at 1310 hours Pacific daylight time, a motorized glider experienced an in-flight breakup while maneuvering near Minden, Nevada. The commercial glider pilot and a passenger were fatally injured and the glider was destroyed. The personal flight was operated by the owner/pilot under the provisions of 14 CFR Part 91. The glider is certificated in the United States in the experimental category for exhibition and racing.



FIGURE 1. A PICTURE OF THE WRECKAGE

A picture of the Minden wreckage is shown in Figure 1. In addition to this mishap near Minden, a similar glider crashed in Spain. This work covers the investigations of both gliders.

This research has been undertaken because there are few opportunities to destructively inspect composite aircraft. The two failed Nimbus glider wings provided structures for which a failure investigation for composite structures could be conducted. Thus, the objective of this program was to conduct a failure analysis of composite structures and determine the tests that are useful for crash investigations and how to avoid pitfalls. The secondary objective was to determine if any anomalies found could have contributed to wing failure. This research was performed with FAA funding at the request of NTSB and in support of an accident investigation.

The investigation focused on the left and right wings, which are primarily constructed with carbon fiber, glass fiber, and epoxy resin. The investigation was divided into five tasks as delineated in Figure 2.

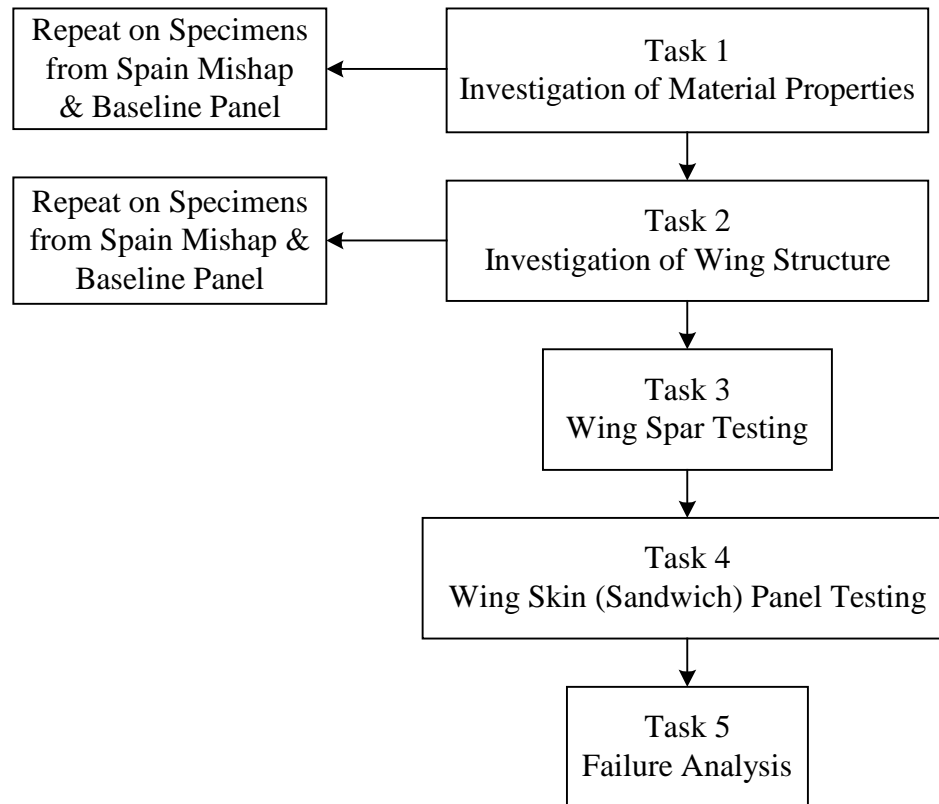


Figure 2. Flow Chart of The Investigation

The objective of Task 1 was to investigate the basic material physical and thermal properties. The glider manufacturer has provided a baseline panel for quality comparison purposes. The comparison between the baseline material and samples taken from the wreckage revealed the physical and thermal property differences, if any, that may influence the structural integrity of the wings.

Task 2 involved an investigation of the wing structure. Schempp-Hirth has provided WSU/NIAR with five engineering drawings showing the layup configurations of the wing. The major part of this task is centered on comparing the layup configuration of the samples from the wreckage with those specified in the engineering drawings.

Task 3 involved extracting specimens from the wing spar for compression, tension, and flexural tests. The specimens were tested for strength as well as ultimate strain. The cross-sectional areas of the spar caps at several locations are compared with the engineering requirements.

Task 4 focused on the wing skin panels. The skins panels were tested in compression and four-point bend modes. The compression test is designed to validate the compressive strength of the foam core. The results are then compared with appropriate engineering requirements. The four-point bend test simulates a facesheet buckling failure mode that

is seen in many location of the wings. The strain level at which the skin buckled yields information about the stress levels of which the wings encountered during the in-flight breakup.

Task 5 analyzed the failure surfaces using a microscope to determine the failure modes. The failure modes provide information about the wing loading that causes the failure of the wing. The predicted wing break sequence is simulated using LSDYNA finite element analysis.